Abstract Submitted
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Refractive index sensing of turbid media by differentiation of the reflectance profile: Analysis of error[1] MIAO DONG, KASHIKA GOYAL, DONALD KANE, BRADLEY WORTH, LALIT BALI, SAMIR BALI, Department of Physics, Miami University — Refractive index detection typically consists of a measurement of the reflectance of light from the sample surface for various angles of incidence, and determining the critical angle for total internal reflection (TIR). A commonly used technique for locating the critical angle is to differentiate the angular reflectance profile with respect to the incidence angle, and look for the point of maximum change of slope. For turbid media this differentiation technique leads to errors in refractive index measurement, which need to be accurately estimated. We show that previous attempts by other workers to calculate the error using traditional Fresnel theory yield an expression that is impossible to physically justify, and hence must be incorrect. We calculate the error using a recent model of TIR in turbid media by Calhoun, et al. (Opt. Lett. **35**, 1224 (2010)) which departs from traditional Fresnel theory, and show that this error varies with turbidity in an expected manner. Important differences from previous work relying on traditional Fresnel theory are revealed with regard to the size of error as a function of turbidity, and the choice of polarization for minimizing error.

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